

The genus *Desmocladus* (Restionaceae) and new species from the south of Western Australia and South Australia

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Abstract

Briggs, Barbara G. and Johnson, L.A.S. (Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia) 2001. The genus *Desmocladus* (Restionaceae) and new species from the south of Western Australia and South Australia. *Telopea* 9(2): 227–245. The name *Desmocladus* Nees was recently adopted for a genus that has been widely confused with *Loxocarya* R. Br. The two genera are not closely allied and the characters distinguishing them are summarised. In addition to the six previously named species of *Desmocladus*, there are eight new species from Western Australia here described (*D. austrinus*, *D. biformis*, *D. castaneus*, *D. elongatus*, *D. lateriticus*, *D. parthenicus*, *D. quiricanus* and *D. semiplanus*) and one that occurs in the south of both Western Australia and South Australia (*D. diacolpicus*).

This paper is dedicated to Emeritus Professor John S. Pate, of the University of Western Australia, who has made notable contributions to an understanding of an extraordinarily wide range of plant groups and of their biology, physiology and structures. He and his students and associates have made great advances in knowledge of Australian Restionaceae.

Introduction

The first description of species now referred to *Desmocladus* was in 1810 when Robert Brown named *Restio fasciculatus* and *R. flexuosus* (Brown 1810). These species were transferred by Bentham (1878) to Brown's genus *Loxocarya* and further species related to them were named within *Loxocarya*. The confusion was widened since Bentham also transferred to *Loxocarya* a species of *Hypolaena*, *H. pubescens* (R. Br.) Nees, which had also originally been named under *Restio*, although it had since been transferred to an appropriate generic placement in *Hypolaena*. The genus *Loxocarya* is, however, typified by *L. cinerea* R. Br. which is generically distinct from all these species.

We therefore adopted (Briggs & Johnson 1998b) the name *Desmocladus* Nees (1846) for a genus typified by *D. fasciculatus* (R. Br.) B. G. Briggs & L.A.S. Johnson. This new combination for the type species was necessary since it had originally been given the illegitimate name *D. brunonianus* Nees. The name *Desmocladus* was used, in the knowledge of our proposed classification and with our encouragement, in the description of *D. glomeratus* K.W. Dixon & K.A. Meney (Meney, Pate & Dixon 1996). Combinations under *Desmocladus* were provided (Briggs & Johnson 1998b) for the further four species of that affinity which had been named under *Loxocarya*. Accounts of the genera of Restionaceae (Linder, Briggs & Johnson 1998; Briggs & Johnson 1999) should assist in resolving the long-standing confusion in the generic classification of these taxa.

Information on the six previously-named species: *D. asper* (Nees) B.G. Briggs & L.A.S. Johnson, *D. fasciculatus* (R. Br.) B.G. Briggs & L.A.S. Johnson, *D. flexuosus* (R. Br.) B.G. Briggs & L.A.S. Johnson, *D. glomeratus* K.W. Dixon & K.A. Meney, *D. myriocladus* (Gilg)

† Deceased 1 August 1997.

B.G. Briggs & L.A.S. Johnson and *D. virgatus* (Benth.) B.G. Briggs & L.A.S. Johnson, is given by Meney, Pate & Hickman (1999). In addition to these species, there are nine that were not collected until recently or that were confused with related species; they are described here. Their names were included in the conspectus of our classification of Australian Restionaceae (Briggs & Johnson 1999). Information on their features and biology, in advance of the formal naming of the new species, is also given by Meney, Pate & Hickman (*loc. cit.*), who provide excellent illustrations. Further information on the anatomy, biology and conservation of the new species is presented by Pate & Meney (1999), Meney, Dixon & Pate (1999) and Meney, Pate, Dixon, Briggs & Johnson (1999). An account of all species of *Desmocladus* will be given in the *Flora of Australia* (Briggs, Johnson, Porter & Krauss, in preparation).

Desmocladus and *Loxocarya*

Since all the previously described species recently transferred to *Desmocladus* were formerly included in *Loxocarya*, it is appropriate to note that these are not closely allied genera. They are differentiated by a wide range of features (Table 1), despite superficial similarities in some species. DNA sequence data from the chloroplast gene *rbcL*, the *trnL* intron and the *trnL*–*trnF* intergenic spacer are now also available (Briggs et al. 2000) and confirm the lack of close relationship between them. On the basis of morphology and culm anatomy the *Desmocladus* and *Loxocarya* groups of genera were recognised (Briggs & Johnson 1998a, 1999; Linder, Briggs & Johnson 2000). The *Desmocladus* group is largely concentrated in southern Western Australia where it includes also *Harperia*, *Onychosepalum*, *Catacolea*, *Kulinia* and *Lepidobolus*, in addition to the eastern Australian *Coleocarya*. The *Loxocarya* group is much less clearly characterised and has included 15 genera in both eastern and western Australia. DNA data support the *Desmocladus* group as a robust clade, but show the *Loxocarya* group as paraphyletic in respect of the *Desmocladus*, *Leptocarpus* and *Winifredia* groups.

Table 1. Morphological, chemical and anatomical characters distinguishing *Desmocladus* and *Loxocarya*.

Character	<i>Desmocladus</i>	<i>Loxocarya</i>
Tepals of female flowers	often absent, if present shed with fruit	4 regularly developed, persistent
Ovary	1–locular	(1–)2 locular
Style	single	mostly 2-branched
Fruit	indehiscent (nut)	dehiscent (capsule)
Seed	not furrowed, surface cells subangular	with a longitudinal furrow, surface cells lobed in outline
Flavonoids (Williams et al. 1998)	luteolin and triclin often present	luteolin and triclin not recorded
Culm anatomy		
Inward projections of stomate guard cells	present	absent
Radial walls of culm epidermal cells	sinuous, outer part thickened	not sinuous, not thickened
Chlorenchyma cell layers	1–2	2–3
Pillar cells in chlorenchyma	absent	present
Sclerenchyma ridges projecting into chlorenchyma over outer vascular bundles	absent	present

Descriptions of new species

1. *Desmocladus lateriticus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A *D. myriocladus* combinatione characterum sequentium distinguitur: apex vaginae culmorum pilis longis (1–3 mm longis) patentibus albisque ciliatus; spiculae masculinae anguste ellipsoideae, 3.0–6.5 mm longae; flores femineae tepalis nullis; vaginae glumaeque herbaceae vel bruneolae.

Type: Western Australia: 30 km NNW of Gin Gin on Brand Hwy (31°08'S 115°46'30"E), 28 Sep 1984, B.G. Briggs 7439 & L.A.S. Johnson ♂ (holo NSW; iso CANB, K, MO, PERTH).

Caespitose, forming small, dense, many-culmed tussocks. Culms repeatedly branched, erect, terete to semi-terete, glabrous or pilose with long hairs, often longitudinally furrowed, smooth or finely striate or minutely tuberculate, to 50 cm tall, 0.5–1.2 mm diam., internodes numerous; culm branches of male plants commonly sinuous-erect, females more flexuose and tangled. Basal sheaths short, 3–8 mm long. Culm sheaths appressed, green to dark red-brown, glabrous or villous, 4–7.5 mm long, truncate, apex fringed by long (1–3 mm) spreading white hairs; lamina 2–3(–5.5) mm long. Male spikelets borne singly or less often in pairs, sessile, axillary at 5–10 successive upper nodes, narrow-elliptic, 3.0–6.5 mm long; 3–7-flowered, glumes 3–8, ovate to lanceolate, acute, 1.6–3.7 mm long, yellow to light brown, glabrous or apically villous, mucro 0.3–1.0 mm long. Female spikelets borne singly at upper nodes, ellipsoid, 4.5–6.0 mm long; 1–(2–3)-flowered, glumes 3–5, ovate, acuminate, 2.3–6.0 mm long, green to pale yellow, usually villous towards apex, mucro 0.4–2.0 mm long. Male flowers: tepals 5, scarious, narrow-lanceolate to linear, acute, ± equal in length or inner tepals occasionally shorter, 1.5–3.3 mm long; anthers 1.0–1.3 mm long. Female flowers lacking tepals. Nut narrow ellipsoid, 2 mm long, dark brown with pale lateral lines, stipitate, the style base persistent as a short apical beak. (Fig. 1g–1j).

The epithet is from the Latin *later*, *lateris*, a brick, referring to the frequent occurrence of the species on soils that include lateritic gravel.

Distribution: occurs in Western Australia from north of Geraldton south to the Regans Ford–Mogumber area and east to Cunderdin. (An isolated population is reported near Williams [Meney, Pate & Hickman 1999] but this should be rechecked cf. *D. quircanus*). Locally occasional to abundant on laterite in heath or open shrubland, frequently on lateritic ridges. Killed by fire.

Conservation status: not at risk.

Distinguished from *D. myriocladus* (Fig. 1a–1c) by the long (1–3 mm), spreading white hairs fringing the apical margin of culm sheaths, the narrow ellipsoid male spikelets 3.0–6.5 mm long, absence of tepals in the female flowers, sheaths and glumes green or light brown. *D. myriocladus* has the apical margin of culm sheaths glabrous or fringed with very short felted hairs, the male spikelets broader (ovoid-ellipsoid) and mostly shorter (3–4 mm long), tepals present in the female flowers, shorter broader nuts and sheaths, glumes and dry culms mostly golden brown.

Selected specimens examined: Western Australia: Irwin: Murchison R., Oldfield ♂ (MEL14902); Moresby Range, 3.9 km E of Hwy 1 at 21.7 km N of Geraldton (5 km N of White Peak Rd), 14 Aug 1991, Briggs 8884a & Johnson ♂ (NSW, PERTH), 8884c ♀ (NSW, PERTH); 31 km W of Three Springs, W end of Nebru Rd at junction with Moorlaby Rd, 30 Sep 1984, Briggs 7515 & Johnson ♂ (NSW, PERTH), 7517 ♀ (NSW, PERTH); Green Head–Coorow Rd, 0.8 km E from Brand Hwy, 17 Jun 1997, Davis 3319 ♀ (PERTH); 11 km S of Cataby on Brand Hwy, 13 Apr 1989, Krauss 132 & Howitt ♀ (NSW, CANB, PERTH); Darling: 7 km SW of Mt Lesueur, 26 Sep 1976, Briggs 6365 ♂ (NSW, PERTH); 16.5 miles [25 km] WNW of Mogumber, 23 Sep 1966, Briggs 855 ♀ (NSW, K, L, PERTH,

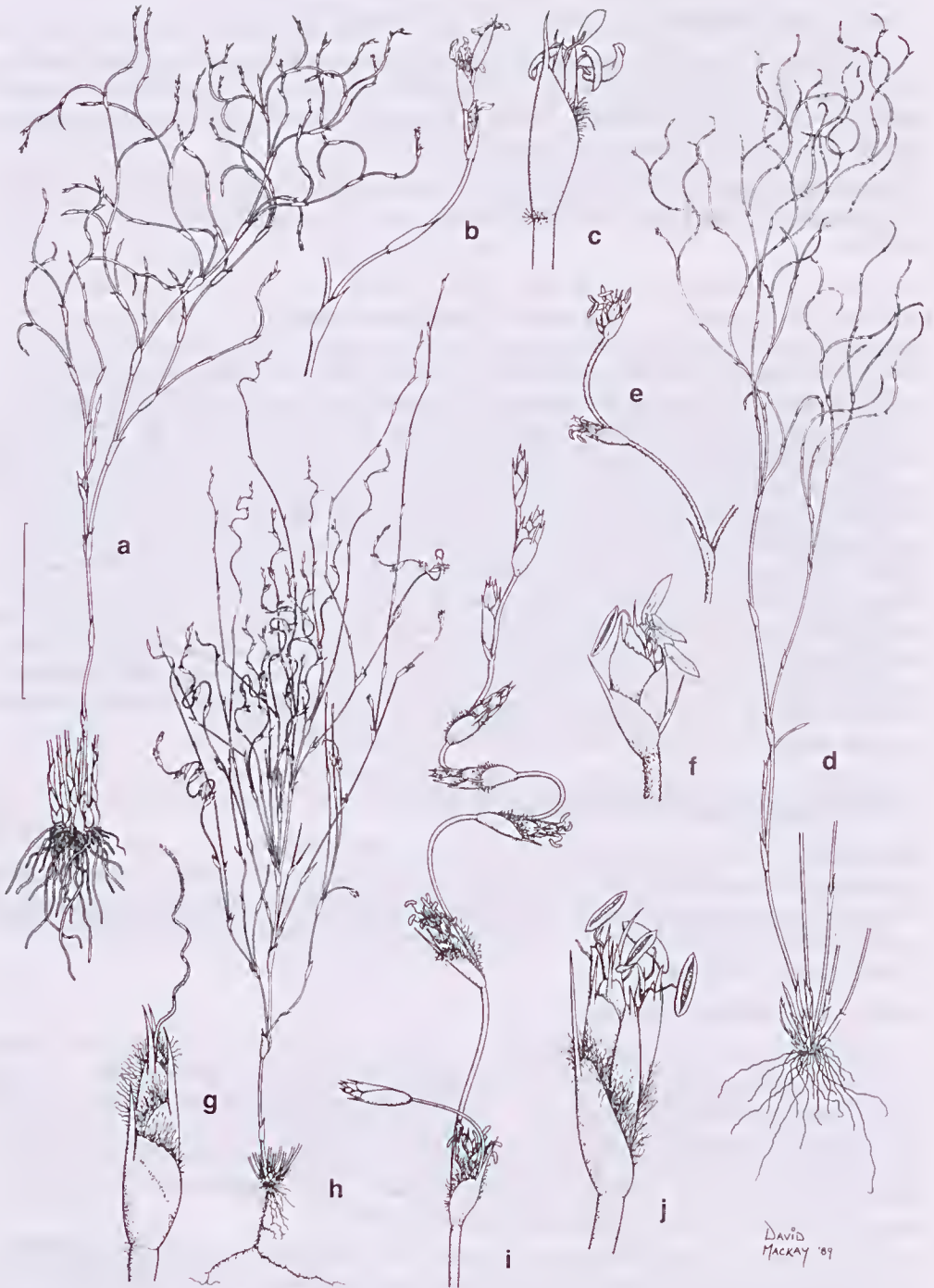


Fig. 1. a–c, *D. myriocladus*, male plant: a, habit; b, inflorescence; c, spikelet (Gibson to Grass Patch, 531 mile peg, Briggs 311, NSW 94960). d–f, *D. quiricanus*, male: d, habit; e, inflorescence; f, spikelet (Briggs 7941 & Johnson). g–j, *D. lateriticus*, g, female spikelet (Briggs 7517); h–j, male: h, habit; i, inflorescence; j, spikelet (Briggs 7439). Scale bar: a, d, h = 4 cm; b, e, i = 1 cm; c, f, g, j = 3.5 mm.

MO); 10 km W of Mogumber on Regans Ford Rd, 2 Oct 1984, *Briggs 7991 & Johnson* ♂ (NSW, CANB, L, NBG, PERTH), 7793 ♀ (NSW, PERTH, PRE); NNW of Gin Gin (details as for type), *Briggs 7443 & Johnson* ♂ (NSW, K, MEL, PERTH, PRE, RSA), 7437 ♀ (NSW, CANB, MO, K, NBG, PERTH), 7444 ♀ (AD, CANB, K, MEL, PERTH, PRE, RSA). Avon: 2 miles [c. 3 km] SW of Cunderdin, 27 Sep 1970, *Salasoo 4370* ♂ (NSW); Youndegin, 1890, *Eaton* ♂ (MEL).

2. *Desmocladus quiricanus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A. D. myriocladus et *D. lateriticus* combinatione characterum sequentium distinguitur: spiculae masculinae breves (2–4 mm longae), obovoideae, glumis numerosis (10–17); vaginae culmorum brunneae vel ferrugineae, sine pilis longis albis; flores femineae tepalis 1–3.

Type: Western Australia: 19 km N of Ongerup on road to Lake Grace (33°47'S 118°29'E), 11 Oct 1984, *B.G. Briggs 7921b & L.A.S. Johnson* ♀ (holo NSW; iso A, CANB, K, L, MO, PE, PERTH, PRE, RSA)

Caespitose. Culms repeatedly branched, sinuous, sparsely to usually densely shortly villous and ± grey, to 30 cm tall, 0.5–1.5 mm diam., internodes numerous. Basal sheaths short, 5–20 mm long. Culm sheaths appressed, 4–9 mm long, glabrous or villous, dark red-brown, apex truncate to obtuse; lamina erect or reflexed, 2.5–4 mm long. Male spikelets solitary or rarely in pairs, ovoid to clavate, 2.0–4.0 mm long; 10–15-flowered; glumes 10–17, ovate, acute, 1.5–2.3 mm long, brown, margins usually villous, abaxial surface often sparsely villous, mucro to 0.8 mm long. Female spikelets borne singly, ellipsoid, 5.0–8.0 mm long, 1-flowered; glumes 4 or 5, ovate, acute, 1.5–4.8 mm long, light to dark brown, villous toward the apex. Male flowers: tepals 5, hyaline, acute, ± equal in length, 1.5–2.2 mm long; outer tepals lanceolate, acuminate, light brown; 2 inner tepals filiform and 1 lanceolate; anthers 0.9–1.2 mm long. Female flowers with 1–3 linear tepals, 3.7–5.0 mm long. Nut ellipsoid, c. 1.5 mm long, smooth, brown with pale lateral lines, stipitate, the style base persistent as a short apical beak. (Fig. 1d–1f).

The epithet commemorates Anna-Louise Quirico (Mrs Garvan), who gave expert technical assistance in studies of Restionaceae and who first recognised the distinctiveness of this species.

Distribution: occurs in southern inland Western Australia from south of Williams eastwards to south of Kulin, Lake Grace, Ongerup and to north of Esperance. Locally rare to abundant on clay or sandy-clay, often subsaline; in poorly drained and seasonally moist depressions in mallee woodland with shrubs or heath. Killed by fire (Meney, Pate & Hickman 1999).

Conservation status: reasonably widespread and sometimes locally common, but in a region where native vegetation has been much depleted.

Distinguished from *D. myriocladus* (Fig. 1a–1c) and *D. lateriticus* (Fig. 1g–1j) by the short broad obovoid male spikelets, 2–4 mm long, with more numerous (10–17) glumes. Also distinguished from *D. myriocladus* by the mostly dark brown or red-brown sheaths and glumes, and from *D. lateriticus* by the lack of long, spreading white hairs fringing the apical margin of culm sheaths, presence of tepals in the female flowers and shorter broader nuts.

Selected specimens examined: Western Australia: Darling: 34 miles [54 km] S of Williams, 28 Jul 1953, *Royce 4209* ♀ (PERTH), 4210 ♂ (PERTH); Beaufort R. Reserve, Apr 1992, *Meney & Pate* ♂ (NSW 254913). Roe: c. 12 km SE of Kulin on road to Tarin Rock, 12 Oct 1984, *Briggs 7941 & Johnson* ♂ (NSW, CANB, MEL, PERTH), 7942 ♀ (NSW, CANB, NBG, PERTH, RSA); Lake Grace, c. 19 km E along road to Lake King, just W of Pungurup Rd, 28 Sep 1992, *Spjut & Smith 12495* ♂ (PERTH); 19 km N of Ongerup (details as for type) ♂ (MEL, NBG, PERTH); Ongerup, at turn-off to town from Gnowangerup to Jerramungup road, 11 Oct 1984, *Briggs 7918 & Johnson* ♂ (NSW, AD,

CANB, K, MEL, MO, PERTH, PRE, RSA); 2.4 km S of Borden on road to Chester Pass, 11 Oct 1984, Briggs 7914 & Johnson ♀ (NSW, CANB, NBG, PERTH); 29.1 km N of Needilup, 11 Nov 1986, Hill, Johnson, Blaxell & Brooker ♀ (NSW 201320); Fitzgerald, N of Grass Patch [as Graspach], 2 Nov 1901, Diels 5296 ♀ (B, NSW) residual syntype of *D. myriocladus* (*Loxocarya myrioclada* E.F. Gilg), not conspecific with lectotype (see Briggs & Johnson 1998b).

3. *Desmocladus biformis* B.G. Briggs & L.A.S. Johnson, sp. nov.

Plantae masculinae culmis erectis, ramulis nullis ad nodos superiores; spiculae masculinae sessiles; plantae femineae ramulis recurvatis ad nodos superiores; spiculae femineae ramulos laterales terminantes.

Type: Western Australia: 3 km N of New Badgingarra on Brand Hwy, just S of Hill R. crossing, 25 Sep 1976, Briggs 6322 ♂ (holo NSW; iso CANB, K, MEL).

Caespitose, forming small, dense, many-culmed tussocks. Culms numerous, erect, terete, glabrous or pubescent, minutely tuberculate, 7–40 cm tall, 0.5–1.0 mm diam., internodes numerous; male plants with culms mostly branched only at lower nodes, straight and erect above; females more sinuous, with a short and strongly recurved branchlet at most upper nodes. Basal sheaths red-brown, to 14 mm long. Culm sheaths 2.5–6.5 mm long, appressed or \pm lax, acute, brown. Male spikelets borne singly at 5–10 upper nodes, sessile on culms or occasionally terminal on lateral branches, ovoid, 5.0–7.0 mm long, 6–18-flowered; glumes 6–18, oblanceolate, aristate, 1.7–2.9 mm long, light brown, glabrous, mucro 0.5–1.2 mm long. Female spikelets mostly terminal on lateral branchlets at 1–10 upper nodes, rarely sessile at culm nodes, ellipsoid, 4.5–8.8 mm long, 1–4-flowered; glumes 4–9, ovate, acute, 2.5–5.0 mm long, light brown, shortly ciliate toward the apex, mucro 0.6–1.6 mm long; the uppermost 1–4 glumes fertile. Male flowers: tepals 5, acute, \pm equal in length or inner tepals shorter, 1.5–2.4 mm long; anthers 1.0–1.3 mm long. Female flowers lacking tepals. Nut ellipsoid, 1.5–2.5 mm long, smooth, brown with pale lateral lines, stipitate, the style base persistent as a short blunt apical beak. (Fig. 2, 3a–3c).

The epithet is from the Latin *bi-*, two and *forma*, form or figure, referring to the dissimilarity in appearance of male and female plants.

Distribution: occurs in Western Australia in a disjunct distribution, from near Eneabba and Badgingarra south to Gin Gin and from the Stirling Ranges to ENE of Jerramungup. Grows in sand or clayey sand, often with some laterite gravel, in heath or shrubland, often with mallee eucalypts. Regenerates from seed after fire (Meney, Pate & Hickman 1999). Sometimes infected by smut fungus (Sieler et al. 1999).

Conservation status: locally common in the south but apparently uncommon in the north where the conservation status of the populations is uncertain and may be vulnerable (Meney, Pate, Dixon, Briggs & Johnson 1999).

Distinguished among the species of *Desmocladus* by the substantial vegetative sexual dimorphism: male plants have straight erect culms, mostly unbranched at the upper nodes, bearing a sessile spikelet at each upper node; culms of female plants are more sinuous, most upper nodes bearing a short, strongly recurved branchlet terminated by a spikelet.

The southern populations were initially considered to be specifically distinct from the northern ones and the unpublished name '*D. tenuis* B.G. Briggs & L.A.S. Johnson unpubl.' was used for them by Williams et al. (1998) and in our determinations in some herbaria. Following further study, plants in the two areas are considered conspecific, although those in the north are mostly taller (to 40 cm), and have somewhat larger spikelets, than those in the south (which are 7–30 cm tall).

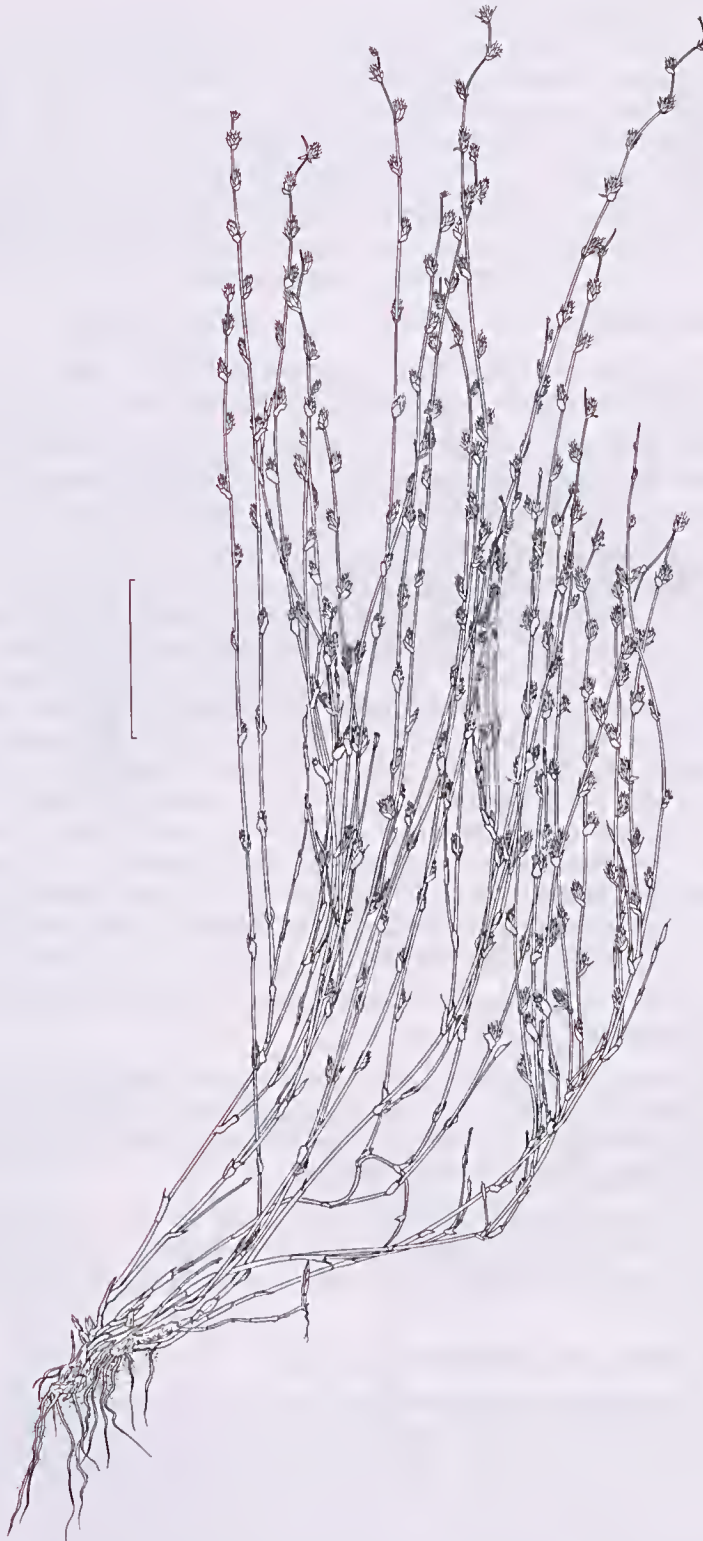


Fig. 2. *D. biformis*, male plant, showing some only of the very numerous culms (Briggs 8615). Scale bar: 4 cm.

Selected specimens examined: Western Australia: Irwin: Lake Indoon Rd 1 km W of Brand Hwy, Sep 1990, *Meney* ♂ (KPBG); Eneabba-Carnamah Rd, E of Rose Rd, E of Eneabba, 3 Dec 1992, *Griffin* 8150 ♀ (PERTH); W of Eneabba on Leeman Road, c. 5 km from Brand Hwy, near Road 8, Indoon, 7 Sep 1990, *Briggs* 8615, *Johnson*, *Meney*, *Pate* & *Linder* ♂ (NSW, BOL, CANB, K), 8616 ♀ (BOL, NSW); 3 km N of New Badgingarra (details as for type), *Briggs* 6321 ♀ (NSW, PERTH); 5 km S of New Badgingarra, 9 Sep 1979, *Keighery* 2521 ♂ (PERTH). Eyre: 2.9 km NE of Young R. on Red Gum Pass Rd, Stirling Range Natl Park, 30 Oct 1988, *Briggs* 8476a & *Johnson* ♂ (NSW), 8476b ♀ (NSW); S of Stirlings, *Chessell* & *McComb* 128, Aug 1964 ♂ (PERTH). Roe: c. 20 miles (32 km) SE of Ongerup, 13 Sep 1966, *Briggs* 491 ♂ (NSW, PERTH), 490 ♀ (NSW, K, MEL, NBG); Chillinup road, 14.4 km SW of Rams Head, 11 Oct 1984, *Briggs* 7895 & *Johnson* ♂ (NSW, PERTH), 7896 ♀ (NSW, PERTH, MEL); 8 km NNW of Mt Drummond, 13 Nov 1986, *Newby* 11395 ♀ (PERTH, NSW).

4. *Desmocladus semiplanus* B.G. Briggs & L.A.S. Johnson, sp. nov.

Culmi concavo-convexi, internodiis 4–6, ramulis 1–3(–4) per nodum instructis; vaginae culmorum brunneae; ramuli plantarum feminearum valde recurvati.

Type: Western Australia: 22.8 km E of Brand Hwy on Green Head–Coorow Road, Alexander Morrison National Park (30°01'S 115°20'E), 30 Sep 1984, *B.G. Briggs* 7735 & *L.A.S. Johnson* ♂ (holo NSW; iso AD, CANB, MEL, PERTH, RSA).

Caespitose, forming small tussocks. Culms erect, concavo-convex, tuberculate, glabrous to densely pubescent with short hairs, to 22 cm tall, 0.8–1.5 mm diam., internodes 4–6; branchlets 1–3(–4) at most nodes, straight to flexuose, culm-like, floriferous, 4–6 cm long. Basal sheaths short, 4–12 mm long. Culm sheaths appressed, mostly red-brown or dark brown, 3.5–7.5 mm long, truncate, glabrous apart from an apical fringe of white cilia; lamina erect, c. 0.5–2.8 mm long. Male spikelets borne singly, terminal on branchlets, ovoid, 5.0–8.0 mm long, 10–14-flowered; glumes 10–14, ovate-lanceolate, 4.0–6.0 mm long, pale brown, hard, acute, apical margin villous, mucro 0.9–1.5 mm long. Female spikelets borne singly, terminal on branchlets, ellipsoid, c. 4–5 mm long, 1-flowered; glumes 4–6, ovate, acute, 2.3–4.0 mm long, reddish brown to pale brown, apical margin ciliate, mucro to 1.2 mm long. Male flowers: tepals 2–5, oblanceolate, ± equal in length or inner tepals slightly shorter, 3.2–5.3 mm long; lower flowers frequently with more tepals than upper flowers; anthers 1.2–1.7 mm long. Female flowers lacking tepals. Nut not seen. (Fig. 3d–3g).

The epithet is from the Latin *semi-*, half, and *planus*, flat, referring to the branchlets that are flattened only on the adaxial surface.

Distribution: occurs in Western Australia from south of Mingenew to Badgingarra. Locally occasional to frequent on deep sand, sometimes over laterite, in heath and woodland; in moderately low rainfall regions; sites seasonally moist. Regenerates by seed after fire (*Meney, Pate & Hickman* 1999).

Distinguished among the species of *Desmocladus* by the mostly concavo-convex culms that have 4–6 internodes and 1–3(–4) branches at most nodes, and by the dark brown culm sheaths; resembling *D. bifornis* in that the branchlets are more strongly recurved on female plants.

Conservation status: not considered to be at risk.

Selected specimens examined: Western Australia: Irwin: 30 km SSW of Mingenew, Moorlaby Rd 20 km S of Midlands Rd, 30 Sep 1984, *Briggs* 7500 & *Johnson* ♀ (NSW, AD, CANB, MEL, PERTH, RSA), 7504 ♂ (NSW, A, AD, CANB, K, L, MEL, MO, PE, PERTH, RSA); Tathra National Park, *Krauss* 150 & *Howitt*, 22 Apr 1989 ♀ (NSW, CANB, K, PERTH); Alexander Morrison National Park (details as for type), *Briggs* 7736a & *Johnson* ♀ (NSW); Arrowsmith R., Oct 1985, *Pignatti* 550 ♂ (RO, NSW); 8 km N of Eneabba, 14 Aug 1976, *Wittwer* 1822 ♂ (PERTH, NSW); 7 km W of Eneabba, 9 Sep 1979, *Keighery* 2564 ♂ (PERTH); Eneabba, 1 Sep 1979, *Haegi* 1921 & *Powell* ♂ (NSW, AD, CANB, PERTH, PRE, RSA); Badgingarra, 9 Aug 1981, *Greuter* 17916 ♂ (B, NSW).



Fig. 3. a-c, *D. biformis*, a & b, female: a, habit; b, spikelet (Briggs 490); c, male: part of inflorescence (Briggs 491). d-g, *D. semiplanus*, d & e, female: d, habit; e, spikelet (Briggs 7736a); f & g male: f, habit; g, spikelet (Briggs 7735). Scale bar: a, d, f = 4 cm; b, e, g = 5 mm; c = 1 cm.

5. *Desmocladus austrinus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A. D. flexuosus habitu caespitoso distinguitur. *A. D. virgatus* combinatione characterum sequentium distinguitur: ramuli longiores et strictiores; spiculae masculinae plerumque solitariae; spiculae femineae breviores (5.5–7.7 mm longae), mucronibus glumarum brevioribus (ad 1.3 mm longis).

Type: Western Australia: Junction of Chillinup Rd and Kojoneerup Rd, c. 12 km (direct) WNW of Wellstead, 13 Sep 1990, *Briggs 8705*, *L. Johnson*, *J. Pate*, *K. Meney* & *P. Linder* ♂ (holo NSW; iso BOL, KPBG, PERTH).

Caespitose, forming few- or many-culmed tussocks. Culms erect, terete, smooth to finely striate, glabrous or pubescent with long hairs, to 70 cm tall, 0.5–1.5 mm diam., internodes numerous; branchlets numerous, 3–16 per node, flexuose and often recurved, slender, to 16 cm long, longer than the internodes so that the upper culm is largely obscured by branchlets, lower branchlets longer than upper. Basal sheaths short, to 10 mm long. Culm sheaths often reflexed, ovate to spatulate, 12–22 mm long, apex truncate; lamina 1.5–10 mm long. Male spikelets mostly borne singly, terminal or sessile and axillary on branchlets, ovoid, 4.0–6.0 mm long, 14–20-flowered; glumes 14–24, narrow-elliptic, acuminate, glabrous, 1.3–2.3 mm long, mucro 0.3–1.3 mm long. Female spikelets borne singly, terminal or sessile and axillary on branchlets, narrow-ovoid, 5.5–7.7 mm long, 1-flowered; glumes 3–8, broadly ovate, acute, 2.3–5.5 mm long, brown, abaxial surface glabrous or sparsely pilose, mucro to 1.3 mm long. Male flowers: tepals 5, scarious, narrow lanceolate, acuminate, ± equal in length, 1.7–2.6 mm long; anthers 0.8–1.4 mm long. Female flowers: 1–5 tepals occasionally present. Nut ellipsoid, 2.5 mm long, smooth, brown with pale lateral lines, stipitate, the style base persistent as a short apical beak. (Fig. 4d).

The epithet is from the Latin, *austrinus*, southern, referring to the species' occurrence in the south of Western Australia.

Distribution: occurs in the south of Western Australia from near Albany and the Stirling Range east to Mt Ragged. Locally abundant in sand or peaty sand or over granite, quartzite or laterite; in heath, shrubland or with mallee eucalypts, near the coast and on ranges some distance inland. Regenerates by seed after fire.

Conservation status: not at risk.

Resembling *D. flexuosus* (Fig. 4e) and especially *D. virgatus* (Fig. 4a–4c), but differing from *D. flexuosus* in its tufted habit and from *D. virgatus* in the lateral branchlets longer and less tightly curled, male spikelets mostly borne singly, and female spikelets 5.5–7.7 mm long with glume mucros to 1.3 mm long. *D. flexuosus* occurs mainly on coastal dunes and headlands, on sand or limestone, from Jurien to Cape Leeuwin and east to Israelite Bay; it is distinctive among these species in its long horizontal or ascending rhizomes, often developing small clusters of erect or ascending culms at widely spaced intervals. *D. virgatus* ranges from Eneabba to Badgingarra and Toodyay, on sand, or sand with laterite, in inland rather than coastal sites; male spikelets are often 2(–3) together; female spikelets 7.2–8.0 mm long, glume mucros to 2.2 mm long.

Selected specimens examined: Western Australia: Darling: Two Peoples Bay, 8 Oct 1984, *Briggs 7644* & *Johnson* ♀ (NSW, AD, CANB, MEL, PERTH, RSA). Eyre: 0.1 km E of Balicup Rd on Salt R. Rd, c. 20 km E of Cranbrook, 30 Oct 1988, *Briggs 8488a* & *Johnson* ♂ (NSW, K, PERTH), *8488b* ♀ (NSW, K, PERTH); 0.4 miles [0.6 km] from Red Gum Springs towards Cranbrook, Stirling Range Natl Park, 10 Oct 1968, *Canning* ♂ (CANB, BRI, NSW); 12.3 km NNE of Young R. on Red Gum Pass Rd., 30 Oct 1988, *Briggs 8481* & *Johnson* ♂ (NSW, AD, CANB, K, L, MEL, MO, NY, PERTH); lower N slopes of Mt Hassell, 8 May 1979, *Keighery 2301a* ♂ (KPBG, NSW), *2301b* ♀ (KPBG, NSW); junction of Chillinup Rd and Kojoneerup Rd, (details as for type) *Briggs 8706 et al.* ♀ (NSW, BOL, KPBG, PERTH); 37 km W of Bremer Bay, 10 Oct 1984, *Briggs 7840* & *Johnson* ♂ (NSW, CANB, PERTH, RSA); SW face of Middle Mt Barren, 17 Jul 1970, *Royce 9033* ♂ (PERTH); summit of East

Mt Barren, eastern side, Fitzgerald R. Natl Park, 3 Sep 1986, *Chapman 519* ♀ (NSW, PERTH); Ganganup [as Gininup Wells], Feb 1911, *Staer* ♂ (NSW 48055), ♀ (NSW 91581); Lucky Bay E of Esperance, 10 Sep 1966, *Briggs 370* ♂, (NSW), 369 ♀ (NSW). Roe: SW slopes of Mt Ragged, $\frac{2}{3}$ rds of the way up, 6 Jan 1979, *Barusley 307* (CANB, NSW, PERTH).

6. *Desmocladus castaneus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A *D. fasciculatus* combinatione characterum sequentium distinguitur: habitus caespitosus, rhizomate haud producto; vaginae basales castaneae; internodia superiora internodia inferiora aequantia.



Fig. 4. a-c, *D. virgatus*, a, male spikelet (18.8 km E of Brand Hwy on Coorow Rd, *Briggs 8620 et al.* NSW 233366); b & c, female: b, habit; c, spikelet (*Briggs 8621*); d, *D. austrinus*, female: floriferous culm (*Briggs 8706 et al.*). e, *D. flexuosus*, female: habit (Parrys Inlet, c. 15 km W of Denmark, *Meuey & Pate* NSW 254910). Scale bar: a, c = 4.2 mm; b, d, e = 10 cm.

Type: Western Australia: Governor Broome Road, c. 3 km E of Scott R. Road, Scott R. Plains (34°15'S 115°18'E), 2 Oct 1976, B.G. Briggs 6052 ♂ (holo NSW; iso K, PERTH).

Caespitose. Culms unbranched but with clusters of 12–22 branchlets at most nodes, erect, terete or furrowed, glabrous to sparsely villous, minutely tuberculate, 5–30 cm long, 0.4–1.2 mm diam., internodes 3–8; branchlets straight or recurved, 1–3.5 cm long, laterally flattened and rectangular in cross section. Basal sheaths often conspicuous, appressed, chestnut-brown, to 16 mm long. Culm sheaths erect, lax, oblanceolate to obovate, 3–9 mm long, obtuse or truncate; lamina erect, 2–3.5(–40) mm long. Male spikelets terminal on branchlets, borne singly or occasionally paired, narrow-ovoid, 4–4.5 mm long, 3–4-flowered; glumes 3 or 4, ovate-lanceolate, 2.2–3.5 mm long, membranous, pale brown, truncate to acuminate, glabrous or ciliate toward the apex, mucro to 1.0 mm long. Female spikelets on branchlets much shorter in fruiting stage than sterile branchlets, narrow-ovoid, 3.5–6.0 mm long, 1-flowered; glumes 2 or 3, ovate to lanceolate, acute, 1.8–4 mm long, light brown, margins pilose, abaxial surface glabrous or pilose toward the apex, mucro to 2.2 mm long. Male flowers: tepals 5 or 6, acute, linear-lanceolate, equal in length or inner tepals shorter, 2.5–4.0 mm long; anthers 1.5–2.3 mm long. Female flowers lacking tepals. Nut ovoid, c. 1.5 mm long, dark brown with pale lateral lines, shortly stipitate, the style base persistent as a blunt apical beak. (Fig. 5a, 6b, 6c).

The epithet is from the Latin *castaneus*, chestnut-coloured, referring to the often conspicuous chestnut-brown basal scales and the usually chestnut-brown culm sheaths.

Allied to *D. fasciculatus* (Figs 5b, 6a) but distinguished by its tufted habit without an extended horizontal rhizome, the colour of the basal sheaths and culm sheaths, the lowest culm internode less than twice as long as upper culm internodes, and the sparser indumentum.

Distribution: occurs in Western Australia in a discontinuous distribution; from near Badgingarra southwards to the Scott R. east of Augusta, and from the Stirling Range eastwards to Cape Le Grand National Park (east of Esperance). Locally abundant in heath and shrubland on sands, often with laterite gravel, in regions of moderate or low rainfall; sites seasonally moist. Unlike *D. fascicularis* which resprouts, *D. castaneus* regenerates by seed after fire (Meney, Pate & Hickman 1999) but seed viability declines rapidly with time (Meney, Dixon & Pate 1999).

In the eastern area of occurrence most, but not all, plants are compact with culms 5–15 cm tall, internodes 2.5–3 cm long and crowded branchlets 1–2 cm long (e.g. Fig. 6b). Plants in the western segment of the range are mostly taller with culms to 25 cm tall, internodes 4–5 cm long and branchlets 2–3.5 cm long (e.g. Fig. 5a, 6c). *D. castaneus* was referred to as '*Loxocarya* sp. D' by Rye (1997), as indicated by Briggs & Johnson (1999). The plant illustrated in Morley & Toelken (1983, p. 371), under the name *Loxocarya fasciculata*, is *D. castaneus*.

Conservation status: widespread and locally common, though unevenly distributed; not at risk.

Selected specimens examined: Western Australia: Irwin: c. 13 km (direct) SSW of Badgingarra, Bibby Rd, c. 2 km W of Brand Hwy toward Cervantes, 6 Sep 1990, Briggs 8580a, Johnson, Meney, Linder & Pate ♂ (NSW, BOL, MEL, PERTH), 8580b ♀ (NSW, BOL, MEL, PERTH). Darling: Serpentine, Sep 1901, Fitzgerald ♂ (NSW 48058); Pinjarra, 30 Sep 1901, Morrison ♂ (K); 1.1 km E of Scott River Rd, on Governor Broome Rd, c. 16 km ENE of Augusta, 11 Sep 1990, Briggs 8673, Johnson, Meney, Pate & Linder ♂ (BOL, KPBG, PERTH), 8674 ♀ (KPBG, PERTH). Eyre: 2 km E of South Stirling, 8 Oct 1984, Briggs 7659 & Johnson ♂ (NSW, AD, MEL, NBG, PERTH, RSA), 7660 ♀ (NSW, A, AD, BOL, CANB, K, L, MEL, MO, NBG, PE, PERTH, RSA); 17 km NNW of Young R. crossing on Ravensthorpe–Esperance Rd, 27 Sep 1968, Donner 2798 ♂ (AD); 39 miles (c. 60 km) W



Fig. 5. a, *D. castaneus*, male (Briggs 6052). b, *D. fasciculatus*, male (Wattle Grove, R. & E.F. Melville & A.S. George NSW 257377). Scale bar: = 4 cm.

of Esperance on Eyre Hwy, 11 Sep 1966, *Briggs* 418 ♂ (NSW, PERTH), 419 ♀ (NSW); Lucky Bay, Cape Le Grand Natl Park, 10 Sep 1966, *Briggs* 400 ♀ (NSW, MEL, PERTH).

7. *Desmocladus elongatus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A *D. fasciculatus* et *D. castaneus* combinatione characterum sequentium distinguitur: culmi (18–)25–40 cm longi; ramuli 5–9 cm longi; ramuli floriferi plantarum feminearum ramulos steriles aequantes. A *D. fasciculatus* etiam habitu caespitoso, internodiis superioribus internodia inferioria aequantia distinguitur.

Type: Western Australia: Coomallo picnic area 24 km NNW of Badgingarra, opposite junction Brand Hwy and Jurien Rd (33°13'30"S 115°23'30"E), 29 Sep 1984, B.G. Briggs 7481 & L.A.S. Johnson ♂ (holo NSW; iso AD, CANB, MEL, PERTH, RSA).

Caespitose, often with some development of short densely intertwined horizontal rhizomes to 2.5 cm long, c. 3 mm diam. Culms unbranched but with clusters of 5–8 branchlets at most nodes, erect, terete to semi-terete, often longitudinally furrowed, minutely tuberculate, sparsely villous, to 40 cm tall, 1.0–1.7 mm diam., internodes 6–9; branchlets straight, 5–9 cm long, laterally flattened and rectangular in cross section. Basal sheaths short, pale brown, to 15 mm long. Culm sheaths broad obovate, 7–18 mm long, sparsely villous; lamina erect, 2–7 mm long. Male spikelets borne singly, terminal on branchlets, elliptic, 7.0–9.5 mm long, 14–20-flowered; glumes 14–21, ovate-lanceolate, 2.8–4.5 mm long, membranous, glabrous, acute, mucro 0.6–1.5 mm long. Female spikelets borne singly, terminal on branchlets as long in fruiting stage as sterile branchlets, ellipsoid, 8.0–9.3 mm long, 1-flowered; glumes 4 or 5, ovate-lanceolate, acute, 3.5–7.0 mm long, dark brown, glabrous, mucro to 1.0 mm long; the uppermost glume reduced, lanceolate. Male flowers: tepals 5, linear-lanceolate, ± equal in length, 2.7–4.2 mm long, acute; anthers 1.3–1.9 mm long. Female flowers: tepals (0–1)2(–3), narrow linear, 2.0–4.5 mm long. Nut oblong, c. 2 mm long, brown with pale lateral lines, stipitate, the style base persistent as a conical beak. (Fig. 6d–6g).

The epithet is from the Latin *elongatus*, referring to the culms and branchlets which are longer than in related species.

Distribution: occurs from north of Eneabba to Cataby in the west of Western Australia. Locally frequent on deep sand over laterite, in heath, mostly in well-drained sites. Regenerates by seed after fire (Meney, Pate & Hickman 1999) but seed viability declines rapidly with time (Meney, Dixon & Pate 1999).

Distinguished from *D. fasciculatus* (Figs 5b, 6a) and *D. castaneus* (Figs 5a, 6b, 6c) by the long culms (18–)25–40 cm tall, branchlets 5–9 cm long and few (5–8) at each node, female spikelets on branchlets as long in fruiting stage as sterile branchlets. Distinguished from *D. fasciculatus* also by the tufted habit and uniform length of internodes. *D. fasciculatus* has culms mostly 8–20 cm long, branchlets 1–2.5 cm long and 14–19 at each node; the lowest internode is more than twice as long as upper internodes.

Conservation status: locally common, not considered to be at risk. It received the conservation code 2KC (referred to as '*Loxocarya elongata* ms.') of Briggs and Leigh (1996), but it is more widespread than originally known. *D. elongatus* was also referred to as '*Loxocarya* sp. C' by Rye (1987).

Selected specimens examined: Western Australia: Irwin: 12 km N of Eneabba, 27 Oct 1981, *Newby* 9403 ♂ (PERTH); Eneabba, 28 Aug 1984, *Bates* 3860 ♂, ♀ (PERTH); Coomallo Picnic area (details as for type) *Briggs* 7483 & *Johnson* ♀ (NSW, A, CANB, K, L, MO, PE, PERTH, PRE, RSA); Boothendarra Rd N of Badgingarra 7 Nov 1988, *Griffin* 5465 ♂ (PERTH); 4 km N of Old Badgingarra, Winjardie Rd 4 km N of junction with North West Rd, 29 Sep 1984, *Briggs* 7489 & *Johnson* ♀ (NSW, CANB, K, MO, NBG, PERTH); 5.6 km E of Brand Hwy along Mullering Rd, 2 Jul 1992, *Cranfield* 8294 & *Spencer* ♂ (PERTH); c. 100 km NNW of Gingin, 2 Sep 1970, *Coveny* 3166 & *Aplin* ♂ (NSW, AD, K, PERTH).



Fig. 6. Portions of inflorescences. **a**, *D. fasciculatus*, male (Wattle Grove, R. & E.F. Melville & A.S. George NSW 257377). **b** & **c**, *D. castaneus*, **b**, male (Briggs 418); **c**, male (Briggs 6052). **d–g**, *D. elongatus*, **d**, male (Briggs 7481); **e**, female spikelet (Briggs 7483); **f**, fruit with attached tepals (Briggs 7483); **g**, male spikelet (Briggs 7481). **h** & **i**, *D. parthenicus*, **h**, part of flowering culm (Briggs 6323); **i**, single node of fertile culm. **j**, *D. diacolpicus*, part of flowering culm (Symon 6271). Scale bar: **a**, **b**, **c**, **d**, **h**, **j** = 3 cm; **e**, **f**, **g** = 6 mm; **i** = 1.5 cm.

8. *Desmocladus parthenicus* B.G. Briggs & L.A.S. Johnson, sp. nov.

A *D. fasciculatus* et *D. castaneus* combinatione characterum sequentium distinguitur: plantae parthenocarpae; ramuli numerosi (c. 40 in quoque nodo); spiculae sessiles. A *D. fasciculatus* etiam habitu caespitoso distinguitur.

Type: Western Australia: 3 km N of New Badgingarra on Brand Hwy, just S of Hill R. crossing (30°22'S 115°30'E), 25 Sep 1976, B.G. Briggs 6323 ♀ (holo NSW; iso PERTH, RSA).

Caespitose; plants all female. Culms unbranched but with clusters of c. 40 branchlets at most nodes, erect, terete, minutely tuberculate, pubescent, to 40 cm tall, 1.0–1.4(–2.5) mm diam.; internodes 5–17, 1–6 cm long, often largely exposed and not hidden by branchlets; branchlets numerous, straight to reflexed, slender, to 2.5 cm long, laterally flattened and rectangular or narrow deltoid in section. Basal sheaths short, to 10 mm long. Culm sheaths 7–13 mm long, sparsely pilose, often reflexed, lamina erect, 2–6 mm long. Female spikelets mostly sessile among the bases of branchlets, numerous at each culm node, occasionally terminal on branchlets, ovoid, 4.0–6.0 mm long, 1-flowered; glumes 4–6, broad-ovate, obtuse, 1.7–3.0 mm long, straw-coloured, abaxial surface glabrous or pilose, mucro to 0.8 mm long; the uppermost glume imbricate and persistent around the fruit after dehiscence forming a striate cone-like cap or coat. Female flowers lacking tepals. Nut ellipsoid, c. 2.0 mm long, shed enclosed in the innermost glume, with a short stipe below that glume and also a very short stipe below the ovary. Setting abundant seed apomictically (parthenocarpic); male plants not known. (Fig. 6h, 6i).

The epithet is from the Greek *parthenos*, a virgin, referring to the parthenogenetic breeding system.

Distribution: occurs in Western Australia from near Kalbarri, inland and south to Tambellup, Ongerup, east of Lake King and near Mt Ragged. Locally frequent to occasional in heath and woodland on sands in low rainfall regions; sites seasonally moist. Regenerates by seed after fire (Meney, Pate & Hickman 1999).

Conservation status: widespread and common.

Distinguished from *D. fasciculatus* (Figs 5b, 6a) and *D. castaneus* (Figs 5a, 6b, 6c) by the dense clusters of numerous (c. 40 per node) branchlets, the mostly sessile spikelets and parthenogenetic breeding system (Pate & Meney 1999). Distinguished also from *D. fasciculatus* by the tufted habit and lack of an elongated basal culm internode.

Selected specimens examined (all ♀): Western Australia: Irwin: 10.5 km E of Kalbarri, 24 Oct 1981, Newbey 9362 (PERTH); 3.7 km from Baline on road to Binu, 13 Aug 1991, Briggs 8880 & Johnson (NSW); 'Burma Rd' c. 30 miles [48 km] SE of Geraldton, 29 Sep 1962, Phillips 1563 (CANB, NSW); c. 29 km W of Mingenew on Dongara Rd, 1 Oct 1979, Wilson 2673 (NSW); Strawberry–Walkaway Rd, 46 km S of Walkaway, 28 Sep 1976, Briggs 6420 (NSW, AD, MEL, PERTH); Coomallo picnic area, 24 km NNW of Badgingarra opp. junction of Brand Hwy and Jurien Rd, 29 Sep 1984, Briggs 7486 & Johnson (NSW); Watheroo Natl Park, W of Watheroo, 6 Oct 1971, Royce 9631 (PERTH). Darling: 4.5 km W of Mogumber on Regans Ford Rd, 2 Oct 1984, Briggs 7789 & Johnson (NSW). Avon: 5.5 km N of Wongan Hills on Craig Rd, 2 Nov 1988, Briggs 8552 & Johnson (NSW, K, PERTH); 15 miles [24 km] S of Tammin, 2 Aug 1968, Royce 8444 (PERTH); Tutanning Reserve, 32 km ENE of Pingelly (Possum Rd near Echidna Rd), 4 Sep 1966, Briggs 183 (NSW, BRI, CANB, HO, K, L, NBG); 10 km WNW of Jitarning, 13 Jan 1978, Hnatiuk 780070 (PERTH); Near Lime Lake c. 13 km S of Wagin, 30 Aug 1959, Eichler 15873 (AD). Roe: c. 16 miles [26 km] SE of Ongerup, 13 Sep 1966, Briggs 481 (NSW, A, CANB, US); Between Gibson and Salmon Gums near 531 mile peg, 8 Sep 1966, Briggs 307 (NSW).

9. *Desmocladus diacolpicus* B.G. Briggs & L.A.S. Johnson, sp. nov.

Plantae parthenicarpaе, a *D. parthenicus* ramulis c. 20 in quoque nodo, spiculis plerumque ramulos laterales terminantibus distinguitur.

Type: South Australia: Hinks National Park, the inner NW angle on the Reserve, S of Verran Hill road exit, 9 Oct 1969, *D.E. Symon* 6271 ♀ (holo AD; iso CANB, NSW).

Caespitose; plants all female. Culms unbranched but with clusters of c. 20 branchlets at most nodes, erect, terete, minutely tuberculate, glabrous or densely pubescent with short hairs, to 20 cm tall or rarely taller, 0.7–1.2 mm diam.; internodes 6–10, often partly exposed and not hidden by branchlets; branchlets slender, straight to flexuose or tightly recurved, to 2.5 cm long, laterally flattened and rectangular or narrow deltoid in cross section. Basal sheaths reddish brown, to 15 mm long. Culm sheaths 8–13 mm long, glabrous or sparsely pilose, often reflexed; lamina erect, c. 5 mm long. Female spikelets single and terminal on branchlets, sometimes appearing sessile at flowering stage but branchlets elongating by fruiting stage, ellipsoid, c. 5.0 mm long, 1-flowered; glumes 3–6, broad-ovate, acute, 1.5–4.3 mm long, brown, abaxial surface glabrous or partially pilose, mucro to 0.6 mm long, the uppermost glume imbricate and persistent around the fruit at dehiscence forming a pubescent cone-like cap or coat. Female flowers lacking tepals. Nut narrow ellipsoid, c. 2.0 mm long, shed enclosed in the innermost glume, with a short stipe below that glume and also a very short stipe below the ovary. Setting seed apomictically (parthenocarpic); male plants not known. (Fig. 6j).

The epithet is from the Greek *dia*, through or between, and *kolpos*, bay or gulf, referring to the species occurrence on both sides of the Great Australian Bight.

Distribution: occurs in South Australia in the Eyre Peninsula and collected from the Ongerup district of Western Australia, c. 130 km NNE of Albany. In heath with mallee eucalypts on sand.

Conservation status: endangered; conserved in part of the range but presumed extinct elsewhere. In South Australia very restricted in occurrence but conserved in Hinks National Park. In Western Australia rare if surviving, restricted in occurrence and in a region subject to extensive clearing of natural vegetation and salinisation; reported as most probably extinct in Western Australia (Meney, Pate & Hickman 1999; Meney, Pate, Dixon, Briggs & Johnson 1999; Pate 2000).

Resembling *D. parthenicus* (Fig. 6h, 6i), especially in the parthenocarpic breeding system and fruit dispersed enclosed in a glume, but distinguished by the shorter culms (mostly less than 20 cm tall), fewer branchlets (c. 20) per culm node and female spikelets mostly terminating branchlets rather than sessile among the bases of the branchlets. Further information on morphology and anatomy of *D. diacolpicus* is given by Pate & Delfs (1999).

Specimens examined (all ♀): South Australia: Eyre Peninsula: along Verran Hill track, Hinks National Park, 8 Oct 1968, *Wheeler* 884 (AD); near Mt Verran, 9 Dec 1959, *Specht* 2001 (AD); Roadside between sec's 90 & 97, Hundred of Wanilla, 25 Nov 1968, *Alcock* 2567 (AD, B, CANB); 25 miles [40 km] NW of Port Lincoln, 10 Oct 1909, *Griffith* (MEL); N end of Boston Harbour, 14 km NNE of Port Lincoln, 12 Jan 1976, *Copley* 4929, (AD); Port Lincoln, 10 Oct 1909, *Griffith* (AD).

Western Australia: Eyre: 10.5 km N of Ongerup, on road to Lake Pingarnup, 13 Sep 1966, *Briggs* 477 (NSW); 35 km SE of Ongerup, 13 Sep 1966, *Briggs* 493a ♀ (NSW).

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References

- Bentham, G. (1878) *Flora Australiensis*, vol. 7.
- Briggs, B.G. & Johnson, L.A.S. (1998a) New genera and species of Australian Restionaceae (Poales). *Telopea* 7: 345–373.
- Briggs, B.G. & Johnson, L.A.S. (1998b) New combinations arising from a new classification of non-African Restionaceae. *Telopea* 8: 21–31.
- Briggs, B.G. & Johnson, L.A.S. (1999) A guide to a new classification of Restionaceae and allied families. Pp. 25–56 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Briggs, B.G., Marchant, A.D., Gilmore, S. and Porter, C.L. (2000). A molecular phylogeny of Restionaceae and allies. Pp. 661–671 in Wilson, K.L. & Morrison, D. (eds) *Monocots–Systematics and Evolution* (Proc. 2nd Int. Conf. Comparative Biol. Monocots, Sydney 1998). (CSIRO: Melbourne).
- Briggs, J.D. & Leigh, J.H. (1996) *Rare or Threatened Australian Plants*. (CSIRO: Collingwood).
- Brown, R. (1810) *Prodromus Florae Novae Hollandiae et Insulae Van Diemen*.
- Linder, H.P., Briggs, B.G. & Johnson, L.A.S. (1998) Restionaceae. Pp. 425–445 in Kubitski, K. (ed.) *The Families and Genera of Flowering Plants vol. 4*. (Springer-Verlag: Berlin).
- Linder, H.P., Briggs, B.G. & Johnson, L.A.S. (2000). Restionaceae—a morphological phylogeny. Pp. 653–660 in Wilson, K.L. & Morrison, D. (eds) *Monocots–Systematics and Evolution* (Proc. 2nd Int. Conf. Comparative Biol. Monocots, Sydney 1998). (CSIRO: Melbourne).
- Meney, K.A., Dixon, K.W. & Pate, J.S. (1999) Seed reproduction and germination ecology of Restionaceae. Pp. 97–108 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Meney, K.A., Pate, J.S. & Dixon, K.W. (1996) New species of Restionaceae from Western Australia. *Telopea* 6: 649–666.
- Meney, K.A., Pate, J.S., Dixon, K.W., Briggs, B.G. & Johnson, L.A.S. (1999) Conservation of Australian Restionaceae. Pp. 465–480 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Meney, K.A., Pate, J.S. & Hickman, E. J. (1999) Morphological and anatomical descriptions of Restionaceae and allied families and their distribution. Pp. 161–461 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Morley, B.D. & Toelken, H.R. (1983) *Flowering Plants in Australia*. (Rigby: Adelaide).
- Nees von Esenbeck, C.G. (1846) Restiaceae. Pp. 56–68 in C. Lehmann (ed.), *Plantae Preissianae*. vol. 2: 56–68.
- Pate, J.S. (2000) Fire response and conservation biology of Western Australian species of Restionaceae. Pp. 685–691 in Wilson, K.L. & Morrison, D. (eds) *Monocots–Systematics and Evolution* (Proc. 2nd Int. Conf. Comparative Biol. Monocots, Sydney 1998). (CSIRO: Melbourne).
- Pate, J.S. & Delfs, J.C. (1999) Anatomical features of Restionaceae and allied families. Pp. 57–70 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).

- Pate, J.S. & Meney, K.A. (1999) Morphological features of Restionaceae and allied families. Pp. 3–23 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Rye, B. L. (1987) Restionaceae. Pp. 908–923 in Marchant, N.G., Wheeler, J.R., Rye, B.L., Bennett, E.M., Lander, N.S. & Macfarlane, T.D. (eds) *Flora of the Perth Region part 2*. (Western Australian Herbarium: Perth).
- Sieler, I.S., Websdane, K.A., Pate, J.S., Meney, K.A. & Dixon, K.W. (1999) Fungal and insect diseases and incidence of herbivory in Restionaceae. Pp. 109–117 in Meney, K.A. & Pate, J.S. (eds) *Australian Rushes, Biology, Identification and Conservation of Restionaceae and allied families*. (University of Western Australia Press: Nedlands).
- Williams, C.A., Harborne, J.B., Greenham, J., Briggs, B.G. & Johnson, L.A.S. (1998) Flavonoid patterns and the revised classification of Australian Restionaceae. *Phytochemistry* 49: 529–552.

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